BIRDS OF THE VISAKHAPATNAM GHATS, ANDHRA PRADESH[1]

S. Dillon Ripley,[2] Bruce M. Beehler[2] and K. S. R. Krishna Raju[3]

(With three plates & three text-figures)

We report the results of four field expeditions to the Visakhapatnam Ghats of Andhra Pradesh conducted between 1975 and 1985. These field surveys recorded 160 species of birds, including 22 species new to this montane area, 11 of which are first records for the Eastern Ghats. Important distributional records include the first peninsular records of *Malacocincla* (*Trichastoma*) *abbotti* and *Anthreptes singhalensis*; the first well-documented record of *Dinopium shorii* for the Peninsula; and first Eastern Ghats records of *Aviceda jerdoni, Dryocopus javensis,* and *Hemicircus canente*. Our findings support the contention that peninsular relicts are remnant humid forest forms and that the montane distribution of most of these species depends on the present availability of moist forest rather than a primary adaptation to upland habitats. Our recent surveys of sites first examined by the Vernay Expedition in 1930 show a significant reduction in forest habitat and a concomitant increase in developed and settled lands. It is suggested that forest fragmentation poses a serious threat to remaining populations of relictual moist forest birds.

Introduction

The modern configuration of the Indian Peninsula is defined by the western and eastern coastal ranges that face the Arabian Sea and Bay of Bengal, respectively, and which converge in southernmost India. The Western Ghats are higher, wetter and biotically richer than the Eastern Ghats, and for these reasons the Eastern Ghats have received relatively little attention by biologists. Regardless of past lack of attention, the Eastern Ghats figure prominently in the biogeography of the Indian Peninsula, and their study is necessary if we are to understand fully the distributional ecology of birdlife of the Subcontinent. These coastal mountains are important because of their influence on peninsular climate and biotic distributions, and, more recently, because they support the last tracts of remnant humid forest in the Peninsula and thus serve as an environmental refuge for the ever-more dissected populations of peninsular forest vertebrates.

In this paper we focus on studies of a segment of the Eastern Ghats — known either as the Visakhapatnam Ghats or the Northern Circars. We report on the results of four visits to this section of the ghats, conducted between 1975 and 1985. In addition, we discuss our observations in light of past studies of the region, to test the working hypothesis that significant man-related changes in the physical and biotic environment are affecting the distribution of the birdlife of the ghats.

[1] Accepted November 1986.

[2] NHB Room 336, Smithsonian Institution, Washington, DC. 20560, U.S.A.

[3] Andhra Pradesh Natural History Society, Kingfisher House, Opp. A. U. Post Office, Visakhapatnam 530 003.

Past Studies in the Visakhapatnam Ghats

The most important single effort to survey the avifauna of the Eastern Ghats was conducted by the Vernay Expedition of the Bombay Natural History Society, with V. S. LaPersonne as chief field ornithologist. The team worked in the Eastern Ghats from April 1929 to June 1930, and sequentially surveyed from south (Salem District, presently Tamil Nadu) to north (various sites as far north as Balasore, Orissa).

The Visakhapatnam Ghats, the largest expanse of high mountains in Andhra Pradesh, were surveyed by LaPersonne between 4 February and 15 May 1930. That party worked at Anantagiri (900 m) from 4-28 February, at Sankrametta (1050 m) from 1 March-19 April, and at Jeypore (900 m) from 20 April to 15 May, 1930. That research produced a number of interesting discoveries including several subspecies new to science (*Sitta castanea prateri*, *Muscicapa poliogenys vernayi*, and *Rhipidura albicollis vernayi*).

Subsequent to that initial study, the region was visited by Abdulali (1945) in May 1944. In this trip, he briefly observed at Anantagiri, Sankrametta, and Lammasinghi (950 m), for a total of six days in the hills. Abdulali (1953) added additional records from the hills near Jeypore and Koraput (Orissa), based on records submitted by G. Gowland and N. A. Leslie. These two contributions by Abdulali added considerably to the avian records for the region, especially in documentation of the presence of open-country, or "plains" avifauna.

In the 1970s K. S. R. Krishna Raju established a bird-banding camp at Lammasinghi, and studied the birdlife in several parts of the Chintapalli plateau (Figure 1). Of greatest interest was his discovery of the first peninsular populations of the Tree Sparrow (*Passer montanus*; Krishna Raju & Price 1973), and the first record in the Eastern Ghats of the Little Spiderhunter (*Arachnothera longirostris*) (Krishna Raju & Selvin 1971).

Trevor Price (1979) spent a year (August 1976-August 1977) studying birds at the village of Lammasinghi. He netted and banded birds extensively, in order to study the effect of migrants on resident populations of forest birds. His study contributed a significant body of knowledge of the birds of the Eastern Ghats, and he made a number of "first records" for the region.

Field Program

The present paper summarizes the results of four field collecting expeditions to the Visakhapatnam Ghats. A party headed by Krishna Raju and other members of the Bombay Natural History Society visited Lammasinghi, Valaspara, and Sapparla in early 1975. The Ripleys, accompanied by Dr. Sálim Ali and Krishna Raju, visited the ghats briefly in March 1981 [Lammasinghi, Milerulu (940 m), Raghavendra Nagar (1000 m), and Lankapakalu (875 m)], making a small collection. Immediately following this, three members of the accompanying BNHS staff visited Bhadrachalam, on the southwestern edge of the Vizag Ghats, verging on the plains of the Godavari river, for the purpose of making a reconnaissance to search for Jerdon's Courser (*Cursorius bitorquatus*). This elusive species, not recorded by ornithologists since 1900, had been recorded from sites in the vicinity of the Vizag Ghats, Bhadrachalam being a locality where the bird had been collected. The party failed to find the courser there, but did make a small but interesting collection of birds, which is included here.

In 1983 Bruce Beehler and Shahid Ali, joined briefly by K. S. R. Krishna Raju and Dr. Sálim Ali, worked in Wangasara (800 m), Lammasinghi, Pedevalasa (1000 m), and

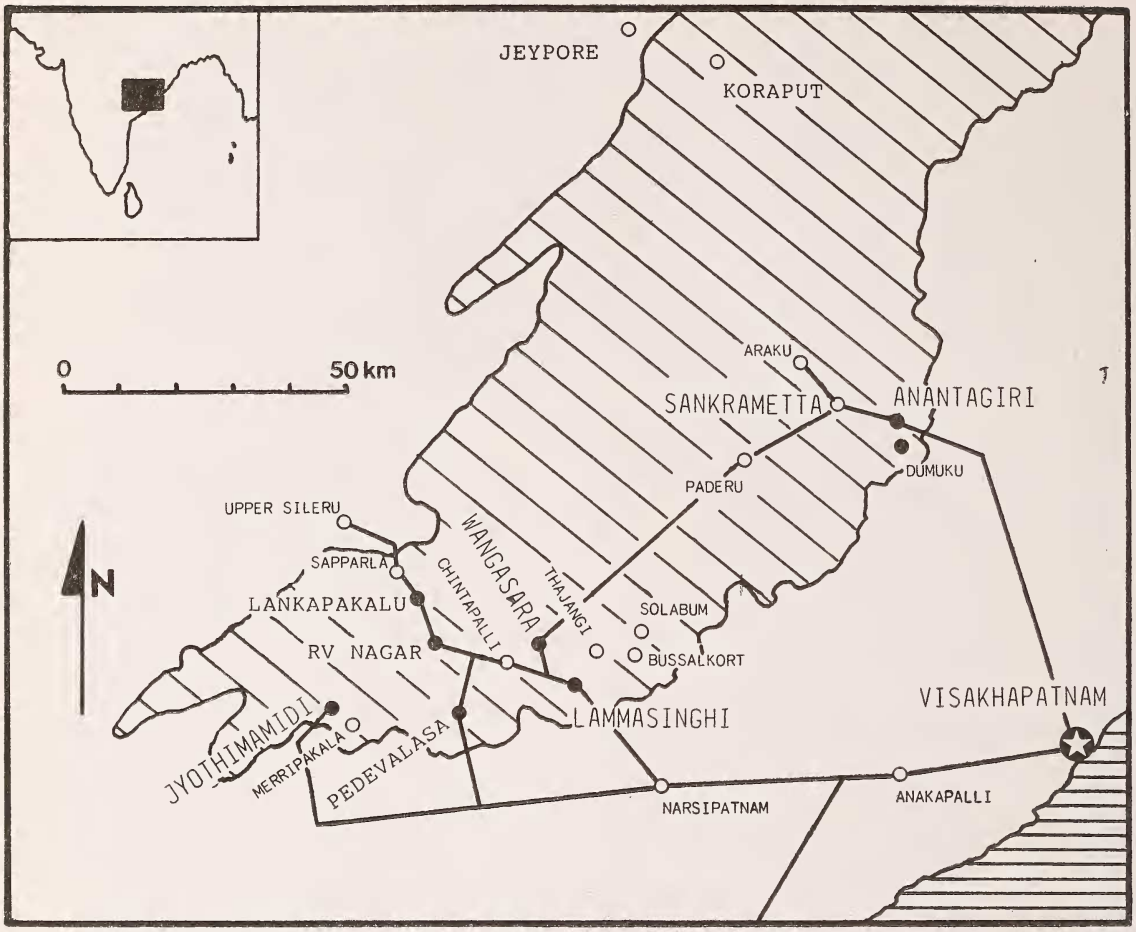


Fig. 1. Map of the Visakhapatnam Ghats, showing our research sites (solid circles) and sites visited by previous researchers (open circles). Some, but not all roads between sites are indicated, schematically. The uplifted region is indicated by the angled hatching, and the Bay of Bengal is indicated by the horizontal hatching in the lower left. Inset shows approximate region depicted by map.

Lankapakalu from 22 September to 26 October (see Figure 1).

Finally, between 19 February and 24 March 1984, the Ripleys and Beehler, accompanied by S. S. Saha, and C. K. Misra of the Zoological Survey of India, and P. B. Shekar of the Bombay Natural History Society, worked in the ghats at Jyothimamidi (450 m), Wangasara, Lankapakalu, and Anantagiri. This last field trip obtained more than 200 specimens of about 100 species, most of which were preserved as study skins, some as skeletons, and some as spirit specimens.

Methods

The goals of the fieldwork were twofold. A primary aim was to continue to document the distribution of birds through the ghats,

which to this day remain imperfectly known. A second goal was to begin to sample bird populations in differing habitats at different sites, in order to determine the extent to which large-scale habitat alteration through the ghats region has affected the structure and composition of local bird communities.

To this end we relied primarily on mist-nets for capturing and sampling birds. Large numbers of birds were captured, most of which were marked and released. Small numbers were preserved for taxonomic analysis and to serve as vouchers to the distributional study. In 1975, 1981, and 1985, collecting was with shotguns supplemented the samples taken with mist-net. This was particularly useful for canopy-dwelling species rarely taken in the nets.

Results

We recorded 160 species of birds in the Visakhapatnam Ghats during our four field trips. This includes 22 species new to the Visakhapatnam Ghats, 11 of which are first records for the Eastern Ghats as a whole, and 2 of which are first records for the Peninsula (Table 1). Considering that three groups

Table 1

Birds recorded for the first time in the Visakhapatnam Ghats

Species	First Record For: Vizag Ghats	Andhra Pradesh	Eastern Ghats	Peninsula
Bubulcus ibis	x			
Aviceda jerdoni	x	x	x	
Accipiter virgatus	x	x	x	
Falco peregrinus	x			
Columba punicea	x	x	x	
Cuculus sparvarioides	x	x		
Bubo bubo	x			
Ninox scutulata	x			
Strix leptogrammica	x			
Caprimulgus asiaticus	x			
Alcedo meninting	x	x	x	
Dinopium shorii	x			
Dryocopus javensis	x	x	x	
Hemicircus canente	x	x	x	
Dicrurus paradiseus	x			
Corvus splendens	x			
Malacocincla abbotti	x	x	x	x
Muscicapa muttui	x			
Prinia rufescens	x	x	x	
Myiophonus horsfieldii	x	x	x	
Turdus ruficollis	x	x	x	
Anthreptes singhalensis	x	x	x	x
Total	22	12	11	2

(LaPersonne, Abdulali, and Price) had worked the region previously, the fact that our sporadic studies established so many distributional records is clear evidence of how little we know of the avifauna. We would encourage continued study of this interesting biota.

Relictual distributions

Of the 160 species recorded from the Visakhapatnam Ghats, some 22 species can be considered relictual — bird species whose restricted populations in the Eastern Ghats' show closest affinity to populations in the Western Ghats, the Himalayan foothills, or Burma and Southeast Asia (Table 2). By all accounts this segment of the avifauna is the most interesting, biologically, and the most threatened by the encroachments of modern civilization.

The Peninsular distribution of these relicts is circumscribed, invariably confined to forest habitat in the ghats (Figure 2). This sort of distributional pattern is well-documented from a number of vertebrate and invertebrate taxa (Hora 1949, Ripley 1949, 1980, Ali 1969, Mani 1974), and defines a vicariance pattern that presumably was brought about by far-reaching

TABLE 2

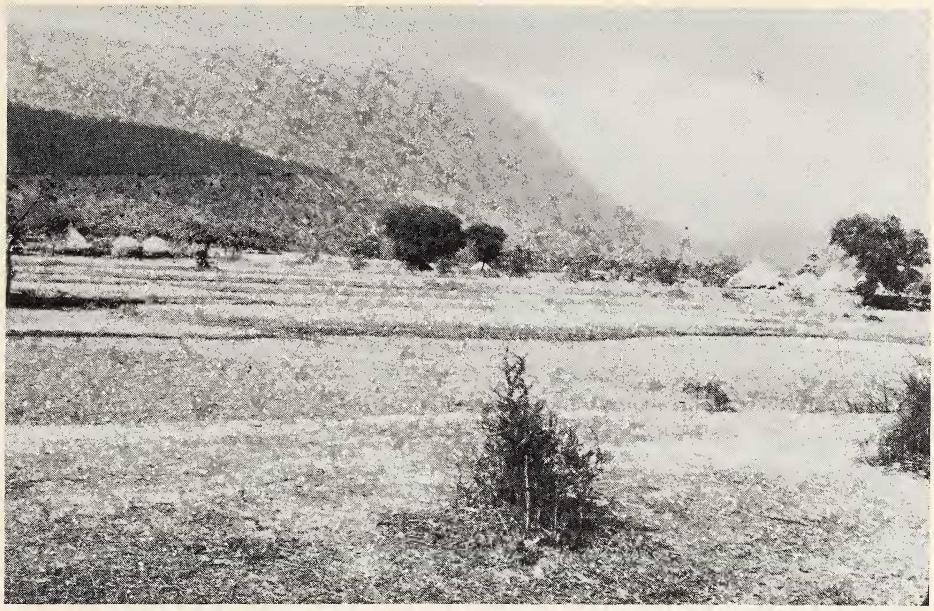
RELICTUAL SPECIES IN THE VIZAG GHATS — PRESENT GEOGRAPHIC AND ALTITUDINAL DISTRIBUTION[1]

Species	Western Ghats	N.E. Hills	Himalaya	Southeast Asia[2]	Lowest Altitude[3]
Aviceda jerdoni	yes	yes	yes	to Sulawesi	sea level
Accipiter trivirgatus	yes	yes	yes	to Philippines	sea level
Accipiter virgatus	yes	yes	yes	to Sulawesi	sea level
Columba punicea	—	yes	—	to Indochina	sea level
Rhopodytes tristis	—	yes	yes	to Sumatra	sea level
Alcedo meninting	yes	yes	yes	to Lombok	sea level
Nyctyornis athertoni	yes	yes	yes	to Hainan	sea level
Picumnus innominatus	yes	yes	yes	to Malaya	sea level
Picus flavinucha	—	yes	yes	to Hainan	sea level
Dinopium shorii	?	yes	yes	to Burma	sea level
Dryocopus javensis	yes	yes	yes	to Philippines	sea level
Hemicircus canente	yes	yes	—	to Malaya	sea level
Gracula religiosa	yes	yes	yes	to Malaya	sea level
Dendrocitta formosae	—	yes	yes	to Hainan	sea level
Tephrodornis virgatus	yes	yes	yes	to Malaya	sea level
Malacocincla abbotti	—	yes	yes	to Malaya	sea level
Stachyris rufifrons	—	yes	yes	to Indochina	sea level
Macronous gularis	—	yes	yes	to Malaya	sea level
Muscicapa poliogenys	—	yes	yes	to Burma	above 3000′
Anthreptes singhalensis	—	yes	yes	to Malaya	sea level
Aethopyga siparaja	yes	yes	yes	to Sulawesi	sea level
Arachnothera longirostris	yes	yes	yes	to Malaya	sea level

[1] See text for full explanation of this table.

[2] We note the easternmost extension of the bird's range here.

[3] Is the bird strictly montane or does it occur at sea level in S.E. Asia?



Above: Looking northward from the plains north of the Godavari, to the heavily forested ghat-face of the Chintapalli plateau. Photo taken *c.* 15 km SE of Pedevalasa.

Below: Lankapakalu campsite at the edge of a permanent mountain stream. Most of the desirable habitat has been cleared of all undergrowth and converted to coffee plantations (see coffee in foreground and right portion of photograph). *Aviceda jerdoni* was collected in the pass above this camp.

(*Photos*: Author)

Jyothimamidi access road, passing through disturbed moist deciduous forest, late March 1985. Some canopy trees are beginning to lose their leaves. Habitat of *Anthracoceros malabaricus, Dicrurus paradiseus, Malacocincla abbotti,* and *Aethopyga saturata.*

Disturbed moist deciduous/semi-evergreen forest at Jyothimamidi. This hill forest habitat supported the richest assemblage of birds of any site we sampled in the ghats.

(*Photos*: Author)

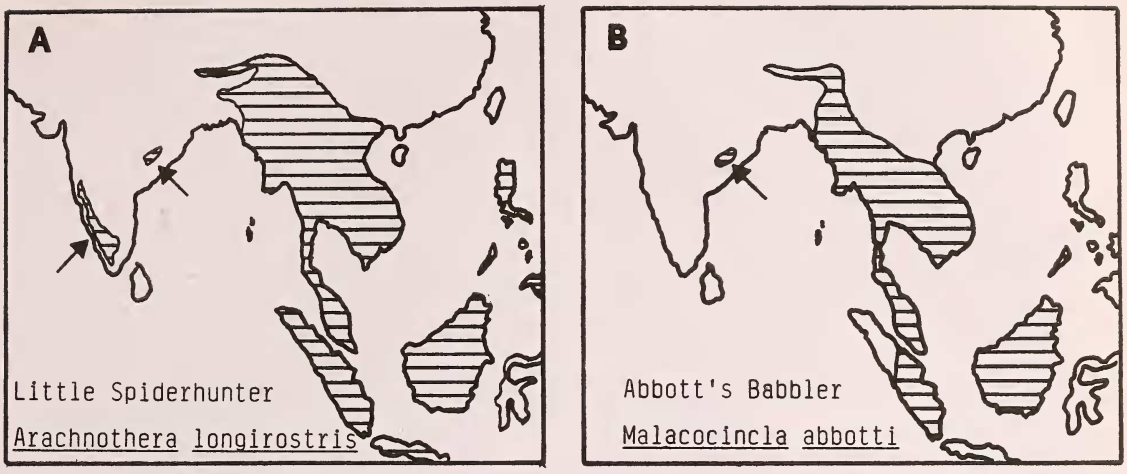


Fig. 2. Distributions of two 'relict' inhabiting the Vizag Ghats. Note the extent of their distributions in southeast Asia (horizontal hatching).

paleoecological events influencing entire biotas (cf. Cracraft 1982).

A major question concerning these relicts centers on the ecological reason for their present relictual distribution. S. L. Hora's "Satpura Hypothesis," sought to explain the anomaly of the northern forms in the far South by postulating a formerly continuous range of mountains higher than 6000 feet extending from the eastern Himalayas across the Peninsula via the Satpura/Vindhya hills, and thence to the Western Ghats. The assumption was that these forms actively 'dispersed' from southeast Asia, and the continuous chain of mountains was hypothesized as a dispersal pathway of a primarily montane fauna from the Himalayas down into southern India. This explained how mountain-loving forms were able to bridge the Garo-Rajmahal Gap and colonize what are now "islands" of montane habitat in the south.

As soon as the Satpura Hypothesis was published, Abdulali (1949) pointed out that it entirely overlooked the Eastern Ghats as a possible corridor of dispersal for Himalayan forms. This is a minor but correct criticism that highlights the long-overlooked importance of the Eastern Ghats as a habitat suitable for a relictual Himalayan biota. Mani (1974: 710ff) has provided a valuable and detailed critique of Hora's theory, and yet he failed, we believe, in presenting a cohesive alternative model for the distributional history of the biota.

We have two criticisms of the traditional explanations for the southern relicts. The first relates to the ecology of the relictual biota. Is the primary requirement of this relictual fauna cool montane habitat or humid forest? Hora studied "hill stream" fishes, and so his fauna was necessarily montane in nature. He believed his hill stream fishes required a continuous montane range in order to "disperse". We believe there is no geological evidence to prove a continuous range as postulated by Hora, and, in addition, we believe such a range is totally unnecessary to explain the present distribution of most relictual forms, especially

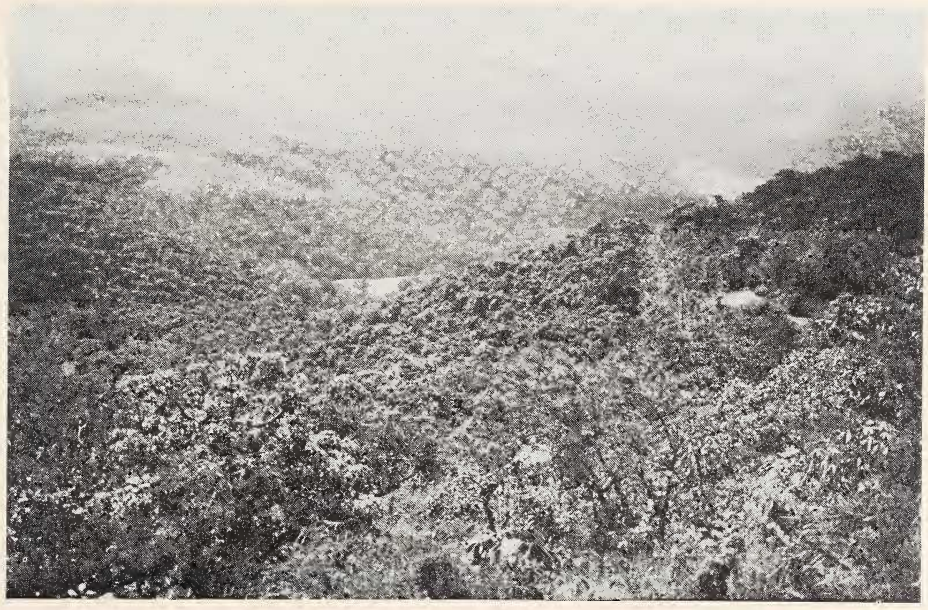
the birds. Many, indeed, most of the relictual forms that inhabit the mountains in South India occupy lowland rainforest in Burma and Southeast Asia.

As shown in Table 2, of the 22 peninsular relicts recorded in the Visakhapatnam Ghats, all but one occur in lowland forest in Southeast Asia, and many inhabit the Greater Sundas and Philippines, Pleistocene land-bridge islands that would have required colonization across extensive expanses of flat lowland habitat during periods when the sea-level was lower. The obvious conclusion is that many of the forms found to be relictual in the Indian Peninsula are confined to montane habitats not because of some 'cool montane' requirement, but because, at present, on the Indian Peninsula, humid forest remnants occur only in association with the mountains, which act to capture rainfall from water-bearing air masses off the Arabian Sea and Bay of Bengal.

Since the species in question are not strictly montane in nature, past distributions on the Peninsula did not necessarily correlate with mountain distributions, given the postulated presence, during earlier periods, of extensive tracts of humid forest on the plains (cf. Randhawa 1945, Ripley 1949, 1980, Prakash 1972). Thus, we postulate that the habitat favoured by the present-day relicts was, for some period, widespread on the Peninsula.

Our second criticism of the traditional biogeographic model devolves from the point made above. These hypotheses invoke the active movement of "propagules" from Southeast Asia, following a montane corridor, to the hills of South India, the last populations being "stranded" when the mountain corridor was broken by subsequent erosional events. We do not believe the colonization process occurred in this manner. Instead, following a "vicariance" model (Figure 3) we envisage the present relictual montane distributions being produced by a series of environmental changes in which a widespread, humid forest biota was dissected, with numerous local extirpations (cf. Cracraft 1982). We suppose that during a period of uniformly wet climate in Asia there was a "Humid South Asian" biota that extended, unbroken, from Sundaland westward through Southeast Asia to all India south of the Himalayas. At this time the humid forest fauna occurred throughout India, and the subcontinent supported a larger fauna than present today, one essentially identical to that in Southeast Asia. At that time when the environment was most humid, we assume that in areas of significant rain shadows there were dry "refuges" that supported relictual dry-habitat forms. Gradual dessication reversed the picture, and the humid forest forms withdrew into the wetter refuges near moisture-capturing mountain scarps, while the dry habitat forms expanded their distributions to the dominant state that they occupy today.

Empirical evidence is available which supports the vicariance model and contradicts predictions of the traditional scenario. The presence of a large relictual fauna on Sri Lanka cannot be explained by a continuous montane corridor (cf. Ripley 1949), but can easily be explained by a Pleistocene land connection in conjunction with the widespread humid environment. Additionally, if one must presume that all colonization followed the linear montane corridor, with a dispersal gradient from northeast to southwest, one would expect a "filtering effect" wherein many species dispersed shorter distances and fewer species dispersed longer distances. Such a filtering effect is not evident in present distributions. Indeed, the southern section of the Western Ghats supports the richest assemblage of Himalayan/Northeastern Hill forms — a phenomenon



Above: Sapparla Village. The road that passes this village is the main transport route across the Chintapalli plateau. Regional development, including forest clearance has proceeded outward from this heavily-used road.

Below: Sapparla summit (*c.* 1200 m). The Lammasinghi-Upper Sileru road climbs over this high pass. Highest dome-like summits support large grassy expanses that are apparently edaphic subclimax grasslands, associated with rich deposits of bauxite.

(*Photos*: Author)

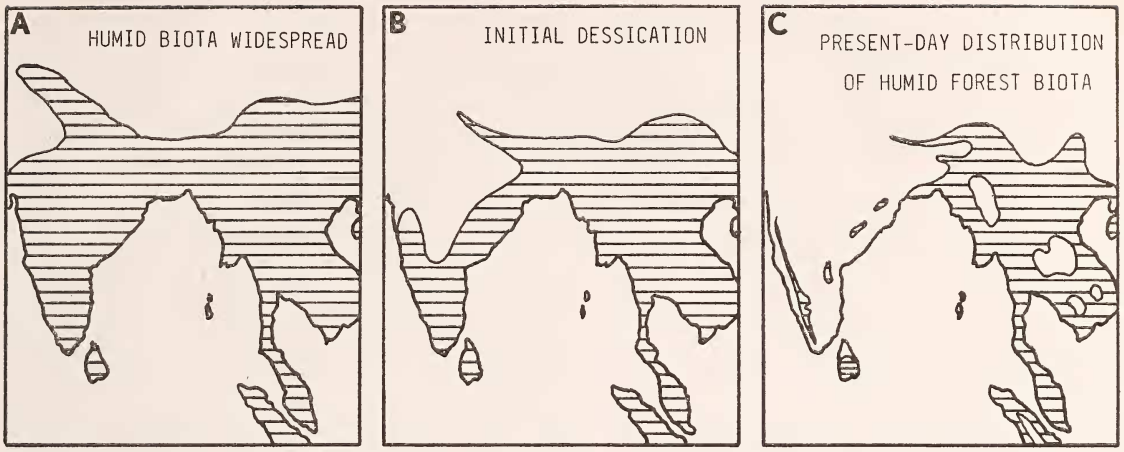


Fig. 3. Hypothetical sequence of contraction of a proposed widespread 'South Asian' humid forest biota. A. Humid forest at its presumed 'maximum', probably in the late Pleistocene. B.-C. Growing dessication and insularization of the biota. Present-day peninsular forest 'relicts' were stranded in humid refuges associated with the rain-capturing scarps of the coastal ranges. Note: coastal outlines are drawn based on present conditions.

easily explained by a combination of vicariance and island biogeographic theory. If the fauna were widespread at the peak humid period, during dessication the largest "islands" of humid habitat would retain the largest assemblages of the relictual biota.

Note, finally, that 9 of the 22 cited northern "relicts" to the Visakhapatnam Ghats are absent from the Western Ghats. Our vicariance hypothesis can explain this simply as a product of chance extinction during the period of dessication. Just as the Western Ghats retained many relicts that (by chance) went extinct in the Eastern Ghats, the Eastern Ghats retained, by chance, some of the former humid forest fauna that, by chance, was lost from the Western mountains. How can Satpura explain this phenomenon? Given the significant lowland barriers isolating the Visakhapatnam Ghats — the Mahanadi drainage to the north and Krishna and Godavari to the south, it is impossible to hypothesize a former continuous montane link to any former source of colonization, whether it be the Western Ghats or the Northeastern Hills.

We believe the processes that produced vertebrate distributions in the past are continuing to operate today. Thus with the continuing dessication and opening of the Indian forests from man-caused forest destruction, we can see an inverse, or "mirror" process in the expansion of the distributions of the dry-country forms. This process is not directional dispersal but instead a gradual growth of avian ranges based on expansion of available habitat. The presence of dry-country endemics in the Indian subcontinent (e.g. Jerdon's Courser or the Yellowthroated Bulbul *Pycnonotus xantholaemus*) may be remnants of a dry-country fauna that never recovered from the last humid phase, when reduction of the dry refuges in interior Deccan rain-shadows brought on the effective "genetic deaths" of some of the dry country species.

Migrants through the Visakhapatnam Ghats

Price's work at Lammasinghi has provided an initial look at the movement of migrants through the Eastern Ghats (Price 1979). Our survey recorded eighteen northern migrant species in the Vizag Ghats (Table 3). Of these,

TABLE 3
NORTHERN MIGRANTS THROUGH THE EASTERN GHATS RECORDED BY OUR SURVEY

Circus aeruginosus
Streptopelia orientalis meena
Cuculus sparvarioides
Muscicapa latirostris
Muscicapa parva
Muscicapa superciliaris
Muscicapa rubeculoides
Muscicapa thalassina
Phylloscopus trochiloides ludlowi
Phylloscopus occipitalis
Seicercus burkii
Erithacus calliope
Erithacus brunneus
Monticola cinclorhynchus
Zoothera dauma
Zoothera wardii
Motacilla indica
Motacilla cinerea

twelve are forest-dwelling forms, and probably depend on the Eastern Ghats as a habitat corridor for seasonal movement. The continued clearing of forest poses a direct threat to these forms either during passage or on their winter quarters. Fifteen of the eighteen migrant species are members of the family Muscicapidae, including the subfamilies Muscicapinae, Sylviinae, and Turdinae.

The thrushes are the group that is probably most sensitive to habitat destruction. One of the species that requires good forest is the Blue Chat *Erithacus brunneus.* Our many records of this species indicate that it probably is a localized winter resident in the Eastern Ghats, inhabiting humid nullah vegetation and remnant patches of semi-evergreen forest. Ghats populations of this and other thrush species should be monitored in the future to determine their status.

Bird Populations past and present

The Vernay expedition surveyed bird populations in the Visakhapatnam Ghats for more than three months in 1930. How do their findings compare with ours, recorded more than fifty years later? It is difficult to directly compare their findings with ours for several reasons. First, The Vernay expedition published records of only 106 species from the region, fully 54 fewer than our list. At least with regard to their northern segment of the Eastern Ghats, the Vernay effort was not as thorough as ours. This can, in part, be accounted for by differences of method. We were able to deploy large numbers of mist-nets, an effective technique unavailable to the LaPersonne party. Mist-netting produced records of a number of species overlooked by the Vernay expedition: *Malacocincla abbotti, Arachnothera longirostris, Turdus ruficollis,* and *Alcedo meninting,* among others.

The Vernay survey recorded seventeen species not noted by our survey. Of these seventeen, all but perhaps one (*Turdus unicolor*) are widespread, open-country forms, not forest-dwellers. More than half of these have been recently recorded in the region by Price (1979). Thus the "raw data" offer no indication of any serious, ghats-wide loss of avifauna during the last 50 years. Of course, this crude comparison potentially misses any localized changes that, when added up, may produce increased insularization of remnant populations, which over the long run may spell doom for a number of species in the region.

In 1985 we visited Anantagiri, the type locality for *Muscicapa poliogenys vernayi* and other endemic populations. Since the Vernay survey worked there the region has been

heavily developed, with large tracts of coffee, intensively grazed areas, and much land under cultivation. Virtually no forest remains except in tiny sinuous strips following deep ravines that are relatively inaccessible. The area could be characterized as "severely disturbed", and the destruction of the original habitat is nearly total. We observed birds in the open habitats and mist-netted in three remnant patches of forest near watercourses. The remnant patches continue to support some of the "relict" species of greatest biological interest. But these populations were, without question, tiny, vulnerable, and isolated from nearest sources of colonization. The forest-dwelling birdlife in this region appears severely threatened.

By contrast, the open-country species, most of which have colonized this upland region from the plains, are abundant in the Anantagiri environs. The man-caused environmental dessication that we witnessed at Anantagiri and in other sections of the Northern Circars is causing a faunal transition, on a local scale, similar to that which we invoked to explain the present distribution of the northern "relict" species. The habitat is opened, surface albedo is raised, annual air temperature increases, and available moisture is reduced. Humid forest forms retreat into protected pockets, and the open-country forms increase in distribution and abundance. Anantagiri, formerly a large forested plateau supporting a distinct regional avifauna has become a disturbed region that environmentally is similar to the plains, with an avifauna that is no longer regionally distinctive. Meteorological records based on incomplete evidence indicate a mean increase of more than 10°C in annual temperature range along the eastern edge of the escarpment.

One apparent exception to the ongoing expansion of the "plains" or open country fauna is Jerdon's Courser, one of India's least-known birds. After the 1981 field trip, the senior author and Dr. Sálim Ali encouraged a small BNHS contingent of the field party to spend several days searching for the bird near Bhadrachalam, on the southwestern flank of the Vizag Ghats. While this and several subsequent attempts failed, five years of effort by the BNHS paid off when in early 1986 a single Jerdon's Courser was trapped near Cuddapah, in southernmost Andhra Pradesh. Many had considered the species extinct. What efforts will now be made to ensure that the courser does not become one of the "lost" before this decade is out, remains to be determined. An all-out effort to learn the habits and habitat-requirements of this apparently crepuscular species should be mounted as soon as possible.

Habitat destruction

The conversion of upland forest into open land has been brought about by several forces. Beginning before Independence, areas in the Northern Circars had been developed by the Department of Forests for plantations of coffee and teak. This has continued and expanded, although with greater planning in more recent years. The forestry program also supports the cropping of bamboo stands, as well as selective timber-extraction from "miscellaneous forest". At the same time, the region has seen an influx of tribal groups from Orissa. These settlers, at odds with the attempts at control by the government, have been politicized, and often act at cross-purposes to the Forest Department, the result being expanded destruction of habitat. Tribal groups, in an attempt to circumvent the control of the land by Forestry, clear-fell large areas, putting them into cultivation in order to gain ownership of the land by its visible development and occupation.

The outcome of this political struggle is that the Ghats are being increasingly threatened

with complete destruction. There are no undisturbed flat tracts of forest on the several plateau expanses that constitute the Northern Circars. The only remaining significant forest is to be found on the ghat slopes and in the rather remote foothills in the southwestern reaches of the uplifted region (e.g. Jyothimamidi). There is no certainty that even fragments of these tracts will be set aside before they are permanently altered. The future of the forest avifauna in Vizag Ghats is thus in real danger.

Annotated List

Following the sequence and nomenclature of Ripley (1982) we present brief species accounts of all birds recorded in our surveys. All localities cited in the accounts are plotted on the map in Figure 1. All linear measurements are made in millimetres, all weights are in grammes. Except where noted, culmen measurement is from base of the skull, and wing measurement is chord, as measured with dividers from the bend in the wing to the tip of the longest primary.

44. **Bubulcus ibis** (Linnaeus).
CATTLE EGRET.

Observed in tight flocks near Chintapalli and north of Pedevalasa, March 1979. Roosted in low trees bordering large fields near villages.

124. **Elanus caeruleus vociferus** (Latham).
BLACKWINGED KITE.

Specimens: 1 male (imm.), Bhadrachalam, 12 March 1975.

Measurements: wing 273, culmen (damaged), tail 127.

Notes: A single bird was observed over a plowed field at Lankapakalu.

125. **Aviceda jerdoni jerdoni** (Blyth).
BLYTH'S BAZA.

Specimens: 1 female (ova very slightly enlarged), Lankapakalu (909 m), 16 March 1985.

Measurements: wing 320, culmen (from cere) 22, tail 218, weight 470.

Soft parts: iris golden yellow, legs dead white, claws black, maxilla and cere black, blue-grey basally, mandible basally blue-grey, with a black tip and black splotch on tomium.

Taxonomy: agrees in size with the northern race *jerdoni*. In plumage it appears identical to specimens from southeast Asia.

Distribution: a first record for the Eastern Ghats. S. S. Saha reported sighting this species at Jyothimamidi in February 1985. Could this individual represent a migrant?

Notes: shot from the canopy of a low tree at the edge of a dirt track through a coffee plantation. Specimen was a non-breeding female; one ovum measured 4 mm.

129-130. **Pernis ptilorhyncus** (Temminck).
HONEY BUZZARD.

Observed at Lammasinghi, 27 October 1983.

132-134. **Milvus migrans** (Boddaert).
PARIAH KITE.

Observed on several occasions on the Chintapalli plateau during March 1985. Taken at Jeypore by the Vernay Expedition.

138. **Accipiter badius dussumieri** (Temminck).
INDIAN SHIKRA.

Specimen: 1 male (testes enlarged), Anantagiri, 20 March 1985.

Measurements: wing 179, culmen (from cere) 12.5, tail 140, weight 118.

Soft parts: iris pinkish red, legs olive-yellow, bill black with grey base, cere greenish grey.

Notes: Collected in roadside scrub.

144. **Accipiter trivirgatus indicus** (Hodgson).
NORTH INDIAN CRESTED GOSHAWK

Specimens: 1 male (t.e.), Jyothimamidi, 24 February 1985. 1 male (t.s.e.) Wangasara, 4 March 1985; Also mist-netted at Wangasara, October 1983.

Measurements: (male) wing 223, 226, culmen (from cere) 18, 16.5, tail 177, 175, weight 293, 280. Unsexed (netted) weight 316, 322.

Soft parts: (male) iris orange, unsexed (netted = ♀?) yellow, deep yellow, legs olive-yellow, (netted unsexed) corn yellow, cere dull orange, gape and base of mandible yellow, maxilla black with a blue-grey base.

149-152. **Accipiter virgatus** (Temminck).
BESRA SPARROW-HAWK

Specimens: 1 unsexed (mist-netted and released) Wangasara, 28 September 1983.

Measurements: wing (chord) 152, tail 122, tarsus 50, bill (from cere) 11, (from feathers) 15.5, weight 114.

Soft parts: iris orange, cere yellowish green.

Notes: throat white with some fine dark streaking. Sides of breast almost solid cinnamon grading into obscure barring on lower breast, flanks and thighs. Wing, tail and body moult was present.

172. **Ictinaetus malayanus** (Temminck).
BLACK EAGLE.

Observed at Wangasara, October 1983, and at Jyothimamidi, February 1985.

193. **Circus aeruginosus** (Linnaeus).
MARSH HARRIER.

Observed at Lankapakalu, March 1985.

197. **Spilornis cheela melanotis** (Jerdon).
LESSER CRESTED SERPENT EAGLE.

Specimen: 1 male (t.n.e.) Wangasara, 12 Mar. 1985.

Measurements: wing 439, culmen 31.5, tail 265.

Soft parts: iris yellow, legs corn yellow, cere and orbital skin yellow, bill blue-grey with a black tip.

Notes: A pair was observed mating on the ground on the roadside at Jyothimamidi, 24 February 1985.

221. **Falco peregrinus peregrinator** (Sundevall).
SHAHIN FALCON.

Observed at Lammasinghi, 27 October 1983.

275. **Galloperdix spadicea spadicea** (Gmelin).
RED SPURFOWL.

Specimen: 1 female (ova enlarged) Valaspara, near Sileru, 16 March 1975.

Measurements: wing 150, culmen 21, tail 111.

299. **Gallus gallus** (Linnaeus).
RED JUNGLEFOWL

Observed at Wangasara, October 1983; Jyothimamidi, February 1985; Lankapakalu, March 1985.

Notes: common in forest and coffee plantations in most parts of the Chintapalli plateau.

311. **Pavo cristatus** Linnaeus.
COMMON PEAFOWL.

Observed at Jyothimamidi, February 1985.

Notes: Common and vocal throughout the forest at Jyothimamidi; extirpated from most areas of the Chintapalli plateau.

314. **Turnix tanki tanki** Blyth.
INDIAN YELLOWLEGGED BUTTON QUAIL.

Specimens: 1 male, Valaspara, near Sileru, 16 March 1975; 1 female (o.n.e.) Lammasinghi, 24 February 1981.

Measurements: (male) wing 77, culmen 14, tail 25.5; (immature female) wing 89, culmen 15, tail 35, weight 58.

Soft parts: (female) iris yellow, legs rich yellow, maxilla dark brown, tomium yellow, mandible yellow with a brown tip.

501. **Treron bicincta bicincta** (Jerdon).
INDIAN ORANGEBREASTED GREEN PIGEON.

Specimens: 1 female (o.s.e.), 1 male (testis 6×15 mm) Jyothimamidi, 27, 28 February 1985; 1 female (ova granular) Wangasara, 28 February 1985.

Measurements: (male) wing 156, culmen (base) 18.5, tail 91, weight 165; (females) wing 155, 163, culmen (base) 19, 19.5, tail 85 (2), weight 138, 149.

Soft parts: (male) iris inner blue, outer pink, legs cherry to mauve pink, bill generally pale turquoise with blue supra-naral patch and greyish ivory tip; (females) iris (a) inner blue, outer ivory, (b) inner blue, outer pinkish orange, legs (a) cherry with dirty white pads of feet, (b) cherry, bill (a, b) tip pale grey-white.

506-507. **Ducula aenea sylvatica** (Tickell)/ **pusilla** (Blyth).
GREEN IMPERIAL PIGEON.

Specimens: 1 female, Bhadrachalam, 12 March 1975.

Measurements: wing 223, culmen 28, tail 120.

Taxonomy: This specimen is small for typical *sylvatica* but large for typical *pusilla.* It seems clear that these two peninsular races are end-points on a cline and probably should be united, as suggested by Abdulali (1971).

Notes: In 1985, one of us (SDR) observed pigeons flying high over a clearing at Lankapakalu that appeared to be of this species.

524. **Columba punicea** Blyth.
PURPLE WOOD PIGEON.

Specimens: 1 male (testis 17 × 6 mm), 1 female (oviduct swollen, ova forming) Jyothimamidi, 24 February 1985.

Measurements: (male) wing 225, culmen (base) 28.5, tail 153, weight 367; (female) wing 221, culmen (base) 27, tail 127, weight 320.

Soft parts: (male) iris red (outer), orange (inner), legs with cherry red tarsal scutes, sides dull purple, nails pale horn, bill vinaceous purple base, grey-green tip; (female) iris red (outer), orange (inner), legs with cherry red tarsal scutes, bill as for male.

537-541. **Streptopelia chinensis** (Scopoli).
SPOTTED DOVE.

Mist-netted at Wangasara, 27 September 1983.

Weights: (unsexed) 105, 110, 124.

Soft parts: (unsexed) iris (a) pink, (b) orange-red, (c) pink.

Notes: netted birds showed no moult.

531. **Streptopelia orientalis meena** (Sykes).
WESTERN TURTLE-DOVE.

Specimen: 1 male (t.n.e.) Dumuku village, nr. Anantagiri, 21 March 1985.

Measurements: wing 194, culmen 25.5, tail 116, weight 202.

Soft parts: iris orange, legs purplish cherry, eye-ring and subocular patch mauve, bill dark violet with a mauve tip.

Taxonomy: Presumably a winter visitor to the region.

Notes: This bird was taken in disturbed open country.

533. **Streptopelia orientalis erythrocephala** (Bonaparte).
PENINSULAR TURTLE-DOVE.

Specimens: 1 (unsexed) Raghavendra Nagar, 1 March 1981; 1 male (t.n.e.), Jyothimamidi, 2 March 1985; 1 female (o.e.) Lankapakalu, 13 March 1985.

Measurements: (male) wing 181, culmen 23.5, tail 115, weight 183; (female) wing 172, culmen 24.5, tail 112, weight 195; (unsexed) wing 178.5, culmen 25, tail 107, weight 198.

Soft parts: (male) iris dull orange, legs dark cherry, orbital skin and base of bill purplish cherry, tip of bill brownish horn; (female) iris dark brown, legs dark cherry-red, eyelids dark cherry, bill dark cherry shading to dark greenish grey; (unsexed) iris orange, legs dull rose, cere and eyelid pink.

Notes: voice is a raucous and grating *coo* (Jyothimamidi, 2 March 1985). Closed forest.

542. **Chalcophaps indica indica** (Linnaeus).
INDIAN EMERALD DOVE.

Specimens: 1 female (o.n.e.), Jyothimamidi, 22 February 1985.

Measurements: wing 172, culmen 23.8, tail 71.5, weight 107.

Soft parts: iris dark brown, legs burgundy red, bill brown basally and coral distally.

Notes: no moult. Mist-netted in forest. This species was abundant at Jyothimamidi. We netted more than 20 individuals.

558. **Psittacula cyanocephala cyanocephala** (Linnaeus).
SOUTHERN BLOSSOMHEADED PARAKEET.

Specimens: 2 males (t.e., imm.), 1 (unsexed) Jyothimamidi, 25 February, 2 March 1985.

Measurements: (males) wing 135, 141.5, culmen (cere) 18, 17.5, tail 189, 215, weight 62, 67; (unsexed) wing 124, culmen 16, tail 122, weight 55.

Soft parts: (males) iris pale tan, dark orange, legs grey or greenish grey, maxilla orange (2), mandible black (2); (unsexed) iris dark yellow, legs dull greenish grey, maxilla yellowish ivory, mandible horn-grey.

566. **Loriculus vernalis** (Sparrman).
INDIAN LORIKEET.

Specimens: 1 male (testis 2 × 3 mm) Jyothimamidi, 25 February 1985; 1 male (t.s.e.), Lankapakalu, 16 March 1985.

Measurements: (males) wing 83, 90, culmen (from cere) 11, 11.8, tail 41.5, 37, weight 31, 35.

Soft parts: iris dark brown or pale whitish cream, legs dull yellow-tan or dull yellowish olive, bill orange or reddish orange.

572. **Cuculus sparvarioides sparvarioides** Vigors.
LARGE HAWK-CUCKOO.

Specimens: 2 immature females (o.n.e.), Jyothimamidi, 23, 25 February 1985.

Measurements: wing 228, 239, culmen 29, 30, tail 185, 186, weight 130, 145.

Soft parts: iris tan or dark brown, legs corn yellow, maxilla black, mandible yellow or yellow-green, black distally.

Notes: Both specimens were taken in disturbed forest.

573. **Cuculus varius varius** Vahl
COMMON HAWK-CUCKOO.

Specimens: 1 immature male (t.n.e.), 1 male (t.n.e.) Wangasara, 5, 9 March 1985.

Measurements: (male) wing 201, culmen (from base) 26.5, tail 153, weight 102; (immature) wing 189, culmen 27.5, tail 160, weight 84.

Soft parts: (male) iris orange, legs ivory yellow, maxilla black, mandible greenish grey, eye-ring yellow; (immature) iris pale tan, legs orange yellow, bill dull green with a black tip, eye-ring yellow.

582-583. **Cacomantis sonneratii** (Latham).
BAYBANDED CUCKOO.

Observed at Wangasara, October 1983 and March 1985, Pedevalasa, October 1985.

588. **Surniculus lugubris dicruroides** (Hodgson).
INDIAN DRONGO-CUCKOO.

Observed at Wangasara, 4 October 1983. Keys to identification were the barred tail coverts and outer tail feathers, and white spots on crown.

590. **Eudynamys scolopacea scolopacea** (Linnaeus).
INDIAN KOEL.

Specimens: 1 male (t.n.e.), Lankapakalu, 15 March 1985.

Measurements: wing 197, culmen (base) 31, tail 199, weight 160.

Soft parts: iris red, legs blue-grey, bill pale greenish horn.

593. **Rhopodytes tristis tristis** (Lesson).
LARGE GREENBILLED MALKOHA

Specimens: 1 female (o.n.e.), Jyothimamidi, 24 February 1985.

Measurements: wing 160, culmen (base) 35, tail 345, weight 105.

Soft parts: iris reddish brown, legs dark bluish gray-black- bill olive greyish green, eye-patch carmine red to dull mauve on nares.

597. **Taccocua leschenaultii infuscata** Blyth.
EASTERN SIRKEER CUCKOO

Specimens: 1 male, Bhadrachalam, 12 March 1975.

Measurements: wing 161, culmen 32, tail 187.

Notes: the Vernay Expedition took a specimen at Sankrametta.

602. **Centropus sinensis parroti** Stresemann.
SOUTHERN CROW-PHEASANT.

Specimens: 1 male (t.n.e.), Anantagiri, 22 March 1985.

Measurements: wing 182, culmen (base) 41, tail 245, weight 258.

Soft parts: iris red, legs black, bill black.

616, 617. **Otus scops sunia** (Hodgson)/**Otus scops rufipennis** (Sharpe).
NORTHERN SCOPS OWL/PENINSULAR SCOPS OWL.

Specimens: 3 males (–, t.e., t.e.), 1 female (o.e.), Jyothimamidi, 25 February, 1, 2 March 1985; 1 male (t.e.), Wangasara, 10 March 1985.

Measurements: (males) wing 130, 133.5, 134, 140, culmen (base) 19, 19.5 (2), 21, tail 52, 53, 53.5, 57, weight 58, 60 (2), 64; (female) wing 137, culmen 19, tail 60, weight 75.

Soft parts: (male) iris lemon yellow or yellow, legs pale brown or dirty greenish, pads yellow ochre, nails dirty flesh, bill dark brown, dark greenish, or dirty greenish yellow, tomia horn; (female) iris lemon yellow, legs dirty greenish brown, pads yellowish, bill greenish horn with dull yellow tip.

Notes: This series keys out by wing formula to *sunia* but by wing-length to either *sunia* or *rufipennis*. Overall measurements generally refer to *rufipennis*. This series shows remarkable plumage polymorphism, with dorsal colour ranging from grey, heavily streaked and vermiculated, to rufous and streaked, to rufous and virtually unstreaked. These differences are reflected in ventral coloration, as well.

623. **Otus bakkamoena bakkamoena** Pennant.
CEYLON COLLARED SCOPS OWL.

Specimens: 1 male (t.s.e.), Lankapakalu, 14 March 1985.

Measurements: wing 164, culmen 22.5, tail 80.5, weight 128.

Soft parts: iris rich mahogany brown, legs greyish brown, bill greyish ivory basally, mandible blue-grey ivory with paler tip, cere ivory with blue-grey tinge.

Taxonomy: This specimen keys out in HANDBOOK to *lettia*. By distribution it should be *bakkamoena*. Examination of the copious USNM holdings provide no clues to the subspecific identity of our specimen. Abdulali (1972: 108) reported a BNHS specimen from Lammasinghi (wing 170, bill 23, tail 8). His determination agrees with that of this paper — in size conforming with *lettia*, but *bakkamoena* by distribution.

625-627. **Bubo bubo.**
EAGLE-OWL.

Heard at Pedevalasa, 18 October 1983 (call: *buu bo*); heard at Jyothimamidi, 22 February 1985.

Notes: Another (unidentified) species of *Bubo* was recorded at Lammasinghi, 23 September 1983, at Pedevalasa, 15 October 1983, and at Lankapakalu, 20 October 1983. The

call was a very low-pitched *hoo — hoohoohoo*, each series given every 10 sec. In both instances two birds were heard calling to each other. This call may belong to the next species.

631. **Bubo zeylonensis leschenault** (Temminck)
BROWN FISH OWL.

Specimen: 1 male (t.n.e.), Lankapakalu, 17 March 1985.

Measurements: wing 402, culmen (base) 50, tail 196, weight 1200 g.

Soft parts: iris orange-yellow, legs dull blackish grey, pads of feet pinkish flesh, nails bluish ivory to ivory, bill blue-grey, cere dark grey-black.

636. **Glaucidium radiatum radiatum** (Tickell).
BARRED JUNGLE OWLET.

Specimens: 2 females (o.e., o.n.e.), Jyothimamidi, 24, 28 February 1985.

Measurements: wing 121, 125, culmen (base) 18 (2), tail 58.3, 59, weight 83, 91.

Soft parts: iris pale yellow or chrome yellow, legs dull yellowish brown or dirty yellow with yellow pads, bill greyish ivory or greenish yellow.

642-645. **Ninox scutulata** (Raffles).
BROWN HAWK-OWL.

Observed at Raghavendra Nagar in March 1981.

659. **Strix leptogrammica indranee** Sykes.
BROWN WOOD OWL.

Specimens: two feathers of this taxon were taken from a mist-net at Lankapakalu in October 1983.

Notes: the species was observed at Pedevalasa, 18 October 1983. It was attracted into close view by an imitation of its distinctive call, a vocalization typical of the genus: *hooa HooHooHooA*.

671. **Caprimulgus indicus indicus** Latham.
INDIAN JUNGLE NIGHTJAR

Specimens: 1 male (o.n.e.) Jyothimamidi, 28 February 1985; 1 male (t.e.), Anantagiri, 20 March 1985; (tail feathers), Lankapakalu, 17 March 1985.

Measurements: (males) 186, 198, culmen 22, 25, tail 122.5, 123, weight 63, 68.

Soft parts: iris dark brown or brown, legs brown with a greyish cast or greyish brown, pads of feet dark or pale flesh, bill blackish brown or dark brown.

675. **Caprimulgus macrurus albonotatus** Tickell
INDIAN LONGTAILED NIGHTJAR.

Specimens: 2 males (t.e.), Wangasara, 6, 8 March 1985.

Measurements: wing 212, 217, culmen 19, 21.5, tail 142, 162. weight 69, 79.

Soft parts: iris dark brown (2), legs pale brown or brownish flesh, bill horn with a black tip, dark brown.

Taxonomy: This and the following form (*atripennis*) were taken at the same site and both were in breeding condition. In full agreement with the detailed arguments of Mees (1985), Ripley & Beehler (1987) treat the two forms as distinct species, with the Wangasara specimens providing evidence for this position. The Vernay Expedition took a specimen of *albonotatus* from Anantagiri.

676. **Caprimulgus atripennis** Jerdon.
JERDON'S LONGTAILED NIGHTJAR.

Specimens: 1 male (t.e.), Wangasara, 6 March 1985.

Measurements: wing 182, culmen 26, tail 109, weight 55.

Soft parts: iris dark brown, legs maroon grey, bill dark brown.

Taxonomy: This is a well-defined population that is easily keyed out. Following Mees (1985), we treat it as a full species (see preceding account).